

Remarks

Reconsideration of the application is urged in view of the amendments above and comments which follow.

In the Office Action, the Examiner cited, for the first time, Rhodes U.S. 6,204,524 and made the Office Action final. As explained in greater detail below, it is submitted that the finality is inappropriate at this juncture, and should be withdrawn. Even if the Examiner maintains the finality, however, the amendments above are to combine the subject matters of claims 1 and 6, cancel claim 6 as a dependent claim, and leave the remaining claim as previously cast. As such, no new issues have been raised, and this response should therefore be entered in any event.

In particular, the Examiner rejects claims 1 and 6 to 10 under 35 U.S.C. § 102(e) as being anticipated by Rhodes, US-6,204,524. In this reference, the region in the substrate said by the Examiner to be for collecting but not storing charge carriers (region 126) is a heavily n-doped region with a dopant concentration level from about 1×10^{15} ions/cm² to about 1×10^{16} ions/cm². In a restriction requirement dated 15 July 2002, the Examiner said that the patent application contained claims directed to patentably distinct species, and required the applicant to elect a single disclosed species. One of the species was embodiment I, illustrated in Fig. 1, and another of the species was embodiment V, illustrated in Figs. 10a and 10b. As a response thereto, applicant elected embodiment V, thus not electing the embodiment in which the carrier collecting region is a (lowly) doped region.

In the final office action, however, the Examiner cites Rhodes US-6,204,524 which relates to the carrier collecting region being a doped region, thus a reference related to embodiment I – an embodiment no longer under consideration. It is submitted that it is not correct to issue a final office action based on a reference cited for the first time and which relates to a non-elected species, and it is respectfully requested that the Examiner withdraw the final office action and enters the amendments filed herewith.

For clarification, however, in the original present patent application, several embodiments were described, one of these embodiments being illustrated in Fig. 1,

and having a lowly doped non carrier storing, carrier collecting region. Unfortunately, the dopant concentration values mentioned in the present patent application, at page 7 lines 29-30 and on several other locations throughout the specification, are wrong: $1 \text{ to } 2 \times 10^{16} / \text{cm}^2$ should have been $1 \text{ to } 2 \times 10^{16} / \text{cm}^3$. This leads to the fact that in the present patent application as well as in the Rhodes prior art patent, a carrier collecting region with a same level of dopant concentration is mentioned, although in the present patent application it is said that the dopant concentration is very low (which was meant to be the case), while in Rhodes it is said that the doped region is heavily doped. A person skilled in the art should realize from reading the values for the dopant concentration in combination with the mentioning of "the dopant density is very low" (page 3 line 35, page 4 line 23, page 5 lines 28 and 32-33, page 6 lines 12, page 7 lines 29 and 31, page 8 line 12, page 9 lines 2 and 13, page 10 line 15, page 12 line 12, page 14 line 20) that an error has been made in the dopant concentration values, as a dopant concentration of $1 \times 10^{15} \text{ ions/cm}^2$ is not considered to be a low dopant concentration level.

Another embodiment of the present invention is described with respect to Figs. 10a and 10b. In that embodiment, the non carrier storing carrier collecting region is substrate under a polysilicon gate instead of a lowly doped region.

Claim 1 has been amended above by combining it with claim 6, albeit with a slightly different wording. An amended claim set is enclosed herewith. Claim 6 has been cancelled without prejudice.

Claim 1 now clearly describes the embodiment illustrated in Fig. 10a, and described on page 15 line 4 to 35. In this embodiment, the non carrier storing carrier collecting region is substrate under a polysilicon gate electrode. The carrier collecting region draws the electrons to the surface.

Rhodes discloses a pixel cell 114 comprising a substrate, a radiation sensitive source of carriers in the substrate, a transfer region, a doped or inverted region – floating region 130 and a planar current flow carrier transport pathway (inversion layer underneath the pulsed gate 108).

Rhodes does not, contrary to the present invention, disclose a region in the substrate for collecting but not storing carriers, this region being substrate under a polysilicon gate electrode. Rhodes does not even disclose a region for collecting but not storing carriers. The region 126 in Rhodes is a heavily doped region (see col.9 lines 19-20), and thus it is known by a person skilled in the art that this region will store carriers. In any event, the present limitation of cancelled claim 6 has been added in into claim 1 in order to overcome a possible further rejection in view of the error in the patent application with regard to the dopant concentration levels.

In Rhodes, the carriers flow through the inversion layer underneath gate 108. If the gate is off, the carriers stay in regions 110 and 126. Thus these regions store carriers. This can be seen from Rhodes, Fig. 3, and the corresponding description on col.5 lines 12-19: a transfer gate voltage is applied to the transfer gate to cause the charge in the n+ region to transfer to the floating diffusion node. For the implementation of a photodiode, the transfer gate voltage is pulsed.

In the present invention, the gate cannot be in an off state. Whatever voltage is applied on the gate, the charges will flow from the region for collecting but not storing charges, through the planar current flow carrier transport pathway, towards the doped or inverted region, the charges being forced in the direction of lower potential.

As can be seen from the above, there is a significant difference between Rhodes and the present patent application in that Rhodes does not comprises a carrier collecting non carrier storing region which is substrate under a polysilicon gate electrode. Rhodes does not hint in the direction of doing this, and neither does any of the other cited prior art documents.

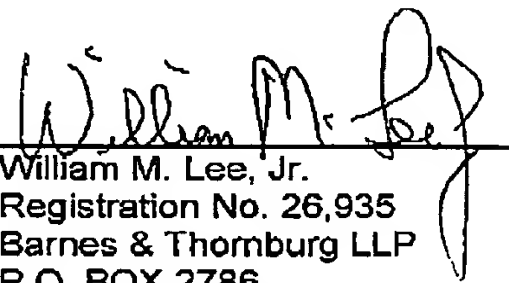
Therefore claim 1 is considered novel and non-obvious in view of the cited prior art, and thus allowable thereover.

Claims 4 to 10 are also considered to be allowable, in view of their dependency on claim 1.

In view of the foregoing, it is submitted that the application is in condition for allowance, and the Examiner's further and reconsideration in that regard is urged.

February 14, 2005

Respectfully submitted,


William M. Lee, Jr.
Registration No. 26,935
Barnes & Thornburg LLP
P.O. BOX 2786
Chicago IL 60690-2786
(312) 214-4800
Fax (312) 759-5646